ARJUNA

JEE

LECTURE - 13

Mole Concept

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02 Formality , molarity of mixture of salt or acid or base

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Q. 10.6 gram Na_2CO_3 dissolved in 200 ml of water . select the correct option

40 – 60 Sec or 1 minute

A *molarity of NaOH is* 1.0 M

B Molarity of Na_2CO_3 is 0.5M

C A and B both option correct

D none of these

$$\text{Molarity of } Na_2CO_3 = \frac{\text{Mole of } Na_2CO_3}{\text{Vol. of soln.}} = \frac{10.6 \,|\, 106}{200 \times 10^{-3}}$$

$$= \frac{0.1 \times 1000}{200} \quad (5)$$

$$= 0.5\,M$$

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Relation between Molarity and Molality

$C_{SD} = 38$

$$m = \frac{M \times 1000}{d \times 1000 - M \times \text{m.wt of solute}}$$

(molality)

d unit: $\left(\frac{g}{ml}\right)$

→ only formula yaad krna hai

Where → d = density of solution $\left(\frac{g}{ml}\right)$

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Q the density of 0.3 M CH_3COOH (Acetic acid) solution is 1.2 g/ml

Calculate molality of solution

$CH_3COOH \rightarrow$ M.wt = 60

IIT JEE → 2008

(a) 0.2 m

(b) 0.4 m

(c) 6.2 m

(d) None of these ✓✓

$$m = \frac{M \times 1000}{d \times 1000 - M \times \text{m.wt of solute}}$$

$$= \frac{0.3 \times 1000}{1.2 \times 1000 - 0.3 \times 60}$$

$$= \frac{300}{1200 - 18}$$

$$= \frac{300}{1182} = 0.25 m$$

Q. A 6.50 molal solution of KOH(aq.) has a density of $1.89 g cm^{-3}$. The molarity of the solution is____ $mol dm^{-3}$. (Round off to the Nearest Integer).

↳ 39+16+1 = 56

[16 March (Shift 1) 2021]

$m = 6.50$ molal

$d = 1.89 \frac{g}{ml}$ or $\frac{g}{cm^3}$

$M = ?$

$1 ml = 1 cm^3$

$$m = \frac{M \times 1000}{d \times 1000 - M \times \text{m.wt of solute}}$$

$$6.5 = \frac{M \times 1000}{1.89 \times 1000 - M \times 56}$$

$6.5 \times 1890 - M \times 56 \times 6.5 = M \times 1000$

$6.5 \times 1890 = M(1000 + 56 \times 6.5)$

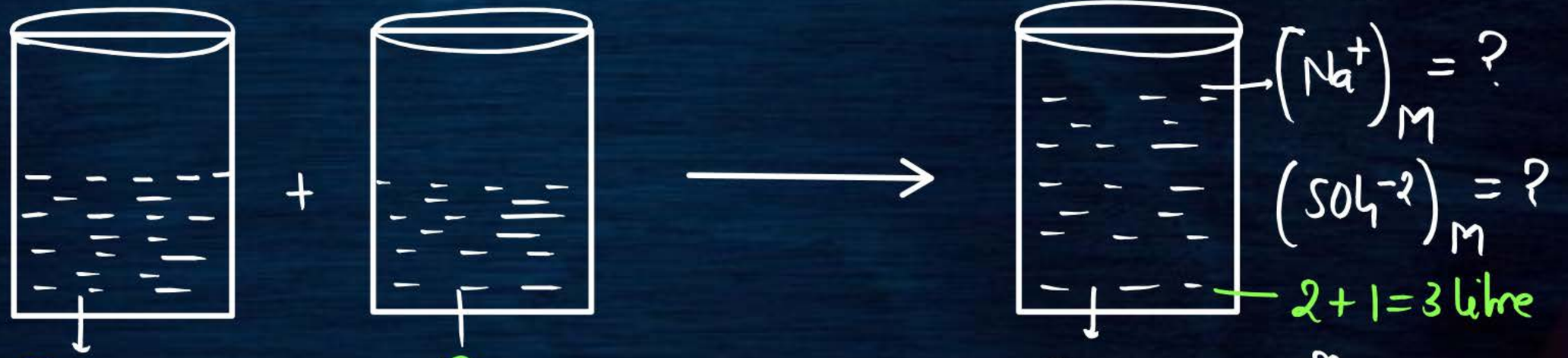
$12285 = M \times 1364$

$M = \frac{12285}{1364}$

$M = 9.0065$

$M \simeq 9$

Molarity of Mixture of salt



2L, 0.1M NaCl 1L, 0.5M K_2SO_4 Resultant sol^n.

$(\text{mole})_{NaCl} = 2 \times 0.1$ mole

$(\text{mole})_{Na^+} = 1 \times 2 \times 0.1 = 0.2$ mole

Molarity of $Na^+ = \frac{\text{mole of } Na^+}{\text{total vol. of sol}^n}$

$= \frac{0.2}{3} = \frac{2}{30} = \frac{1}{15}$

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$C_{SD} = 39$

Case-1 → gf Common not present in mixture of salt

A_aB_b - salt-1 , M_1, V_1

C_cD_d - salt-2 → M_2, V_2

→ Molarity of A^{+1} ion = $\frac{\text{Mole of } A^+}{V_1+V_2} = \frac{a \times M_1V_1}{V_1+V_2}$

→ Molarity of D^- ion = $\frac{\text{Mole of } D^-}{V_1+V_2} = \frac{d \times M_2V_2}{V_1+V_2}$

→ Molarity of B^- ion = $\frac{\text{Mole of } B^-}{V_1+V_2}$

Case-2 If Common ion present in mixture of salt

Ex → 2L, 0.5M Na_2SO_4 = $2 \times 0.5 \times 2$ mole of Na^+

+

1L, 0.4M $NaCl$ = $1 \times 0.4 \times 1$ mole of Na^+

Calculate molarity of Na^+

$$(M)_{Na^+} = \frac{(\text{mole})_{Na^+}}{\text{Vol. of sol}^n} = \frac{2\times0.5\times2+1\times0.4\times1}{2+1} = \frac{2.4}{3} = 0.8\,M$$

V_1 L, M_1 A_aB_b → salt-1

V_2 L, M_2 A_xC_b - salt-2

$$[A^{+}]^{b}_{M} = \frac{aM_1V_1 + x \times M_2V_2}{V_1+V_2}$$

Q 2 litre, 0.2 M Na_2SO_4 mixed with 1 litre, 0.1 M $CaCl_2$ solution

Calculate molarity of Na^+ in resultant solution

(a) $\frac{0.4}{3}$ M → $(Na_2SO_4)_M$

(b) $\frac{0.4}{2}$ M

(c) $\frac{0.8}{3}$ M → $(Na^+)_M$

(d) None of these

$$(M)_{Na^+} = \frac{(\text{Mole})_{Na^+}}{\text{Vol. of resultant sol}^n} = \frac{2 \times M_1 V_1}{V_1 + V_2}$$

$$= \frac{0.2 \times 2 \times 2}{2+1} = \frac{0.8}{3} \text{ M}$$

$$\text{Molarity} = \frac{\text{mole of solute}}{\text{vol. of sol}^n.}$$

$$\text{mole of solute} = \text{Molarity} \times \text{vol. of sol}^n.$$

$$\boxed{\text{mole of solute} = M \times V\,(\text{litre})}$$

$$\text{mole of } A_xB_y = M_1 \times V_1$$

$$\Rightarrow \text{mole of } A^{+y} = x \times \text{mole of } A_xB_y$$

$$= x \times M_1V_1$$

Q. 100 ml, 0.2M NaCl solution mixed with 400 ml, 0.5M $CaCl_2$ solution. Calculate concentration (molarity) of Cl^- ion

A. 0.4 M

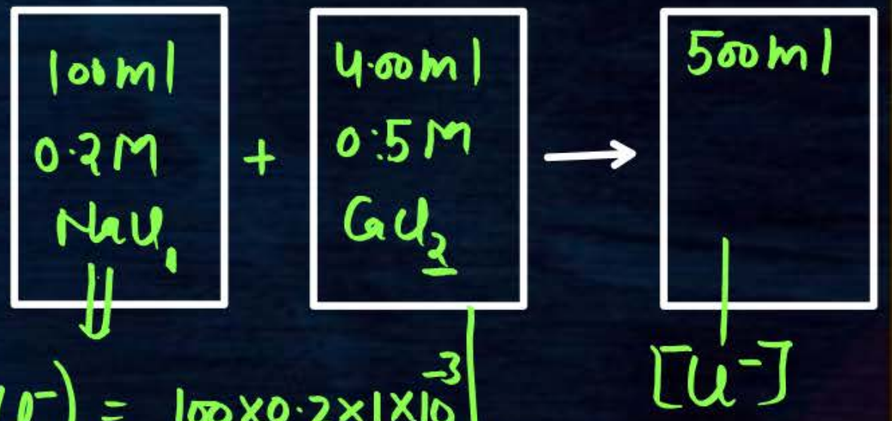
B. 0.5M

C. 0.84 M

D. 0.6 M

$\frac{20+400}{500} = \frac{420}{500}$

$= \frac{42}{50} = 0.84$



$(Cl^-)_{mole} = 100 \times 0.2 \times 1 \times 10^{-3}$

$(mole)_{Cl^-} = 400 \times 0.5 \times 2 \times 10^{-3}$ mole

$(Molarity)_{Cl^-} = \frac{mole\ of\ Cl^-}{Vol.\ of\ sol^n}$

$= \frac{100 \times 0.2 \times 10^{-3} + 400 \times 0.5 \times 2 \times 10^{-3}}{(100+400) \times 10^{-3}}$

$= \frac{20 \times 10^{-3} + 400 \times 10^{-3}}{500 \times 10^{-3}} = \frac{420}{500} = \frac{42}{50} = 0.84M$

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Q 100ml, 0.4 M K_2SO_4 + 100ml, 0.2 M KNO_3,

Calculate

(a) Molarity of K^+ in resultant = $\frac{80+20}{200} = \frac{100}{200} = \frac{1}{2}$ M

(b) Molarity of SO_4^{-2} in resultant sol^n = $\frac{100 \times 0.4 \times 1}{200} = 0.2$ M

(c) Molarity of NO_3^- in resultant solution = $\frac{100 \times 0.2 \times 1}{200} = 0.1$ M

Molarity of Mixture of acid or base

C_{SD} = same Concept used → mixture of salt

Q. 100 ml, 0.2M HCl solution mixed with 400 ml, 0.5M HCl solution. Calculate concentration (molarity) of HCl in resultant solution

A. 0.44 M

B. 0.5M

C. 0.84 M

D. 0.6 M

Molarity of HCl = $\frac{\text{Mole of HCl}}{\text{Vol. of sol}^{n}.}$

$= \frac{20 + 200}{500}$

$= \frac{220}{500} = \frac{22}{50} = \frac{11}{25} = 0.44$

Q 200ml, 0.4M NaOH mixed with 800ml, 0.1M NaOH sol^{n}.

Calculate conc. of NaOH in resultant sol^{n}.

(a) 0.16M

(b) 0.32M

(c) 0.08M

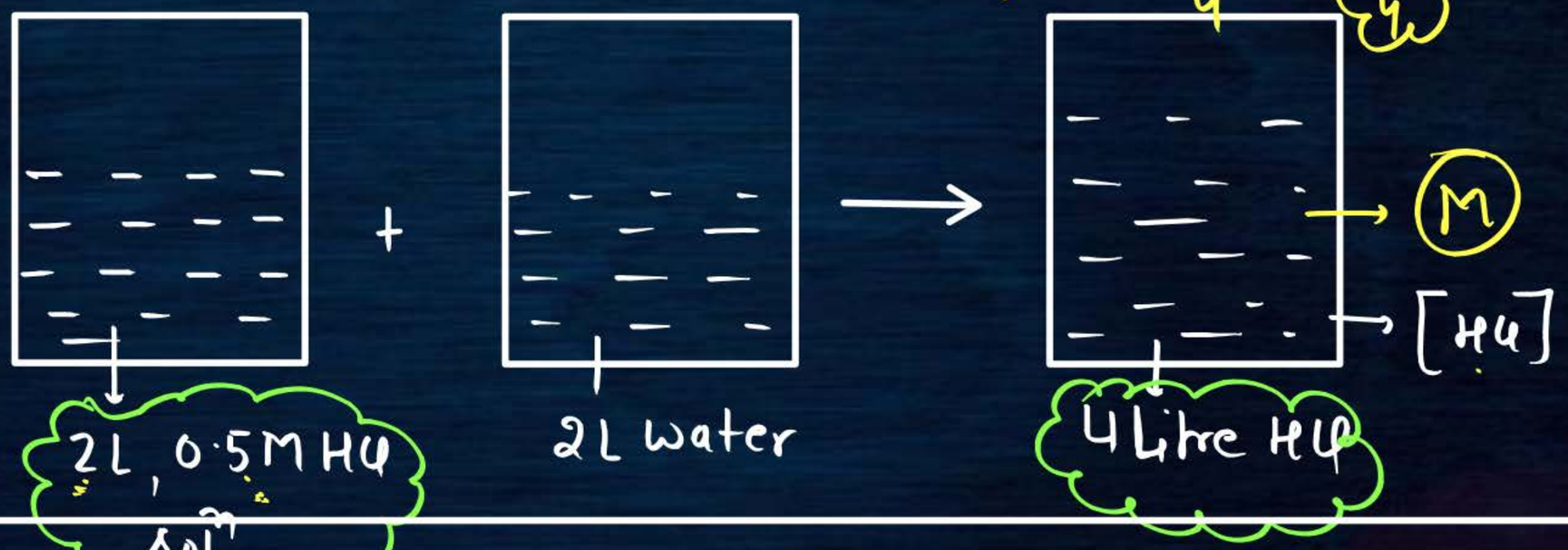
(d) None of these

Molarity of NaOH = $\frac{80+80}{1000} = \frac{160}{1000} = 0.16M$

Find the concentration of solution on dilution

only addition of solvent (water)

$2 \times 0.5 = 4 \times M$, $M = \frac{2 \times 0.5}{4} = \frac{1}{4}$



$C_{SD} = \frac{1}{4}$

(Mole of solute) before dilution = (Mole of solute) After sol^n.

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Q 100 ml, 0.2 M H_2SO_4 solution diluted with water and make 1000 ml of resultant solution. Calculate Con. of H_2SO_4 in resultant solution.

(a) 2×10^{-2} M

(b) 2 M

(c) 2×10^{-1} M

(d) None of these

(Mole of solute)$_{\text{before dilution}}$ = (Mole of solute)$_{\text{After dilution}}$

$100 \times 0.2 \times 10^{-3} = M \times 1000 \times 10^{-3}$

$M = \frac{0.2}{10} = 2 \times 10^{-2}$

Formality

Molarity of ionic comp. is called formality

→ total No. of mole formula unit of solute dissolve in 1 litre of solution

$$\text{Formulity} = \frac{\text{No. of mole of formula unit of solute}}{\text{Vol. of sol}^{n}\text{ (litre)}}$$

Home work

DPP- No. = 7, 8, 9

Complete Krna hai

Thank - You